

Utah Division of Air Quality

Wildfire Smoke Exceptional Events at Spanish Fork August - September, 2018

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Introduction

The Code of Federal Regulations (40 CFR 50.14) states that “a State...may request the Administrator (Environmental Protection Agency) to exclude data showing exceedances or violations of any national ambient air quality standard that are directly due to an exceptional event...by demonstrating to the Administrator's satisfaction that such event caused a specific air pollution concentration at a particular air quality monitoring location.” An exceptional event means an event that affects air quality, is not reasonably controllable or preventable, or a natural event, such as a wildfire.

The demonstration to justify data exclusion, as outlined in 40 CFR 50.14, specifies that the following evidence must be provided:

- A narrative conceptual model that describes the event;
- There is a clear causal relationship between the measurements under consideration and the event that is claimed to have affected air quality in the area;
- Analyses comparing the claimed event influenced concentrations to concentrations at the same monitoring site at other times;
- A state must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards by developing and implementing a mitigation plan for recurring events and;
- The Event documentation must be made available for a 30-day public comment period.

This documentation is being submitted to EPA in order to exclude PM_{2.5} exceedances of the 24-hour standard of 35 µg/m³ that occurred at the Spanish Fork monitoring station due to smoke from multiple wildfires.

The following filters exceeded the PM_{2.5} 24-hour standard (in µg/m³).

Date	Value	Wildfire Sources
8/7/2018	37.8	Coal Hollow
8/9/2018	50.8	Coal Hollow and other western state(s) fire(s)
8/10/2018	68.8	Coal Hollow and other western state(s) fire(s)
8/11/2018	49.6	Coal Hollow and other western state(s) fire(s)
8/13/2018	58.1	Coal Hollow and other western state(s) fire(s)
9/14/2018	71.5	Pole Creek and Bald Mountain
9/15/2018	42.6	Pole Creek and Bald Mountain
9/17/2018	74.5	Pole Creek and Bald Mountain
9/18/2018	57.7	Pole Creek and Bald Mountain
9/19/2018	76.3	Pole Creek and Bald Mountain
9/21/2018	39.3	Pole Creek and Bald Mountain

The following continuous monitor 24-hour average exceedances of the PM_{2.5} 24-hour standard (in µg/m³);

8/7/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	38.8	43.0	49.5	54.7	64.2	64.7	72.9	72.2	81.4	36.6	31.6	33.0	28.3	22.3	24.0	20.2	18.6	18.5	16.7	14.2	13.4	15.3	15.6	15.8	36.0	81.4	08

8/9/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	21.7	103.7	106.6	116.9	131.9	114.8	102.2	142.9	84.1	17.5	17.7	23.1	27.3	28.3	23.2	19.6	13.2	15.1	15.9	16.3	17.4	14.5	31.5	63.5	52.8	142.9	07

8/10/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	84.1	94.0	71.0	152.5	122.3	94.8	80.9	58.3	96.1	78.7	84.3	45.5	36.6	29.8	32.2	30.0	29.0	28.9	32.6	33.4	32.2	33.3	44.8	68.4	62.2	152.5	03

8/11/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	95.4	74.9	76.7	64.8	63.1	63.1	60.1	58.1	44.8	46.8	50.4	41.9	41.6	41.5	34.6	25.4	24.1	22.7	31.8	34.5	31.8	12.9	9.0	7.9	44.0	95.4	00

8/13/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	35.1	44.9	72.4	108.7	128.6	131.4	101.7	157.1	131.8	114.5	50.8	22.8	15.6	17.1	15.3	15.0	14.4	15.9	16.3	20.2	13.5	11.1	13.8	13.7	53.4	157.1	07

9/14/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	12.2	61.7	79.0	100.5	115.4	132.5	128.5	145.0	138.1	195.4	134.3	39.1	24.9	15.2	7.5	3.9	2.8	2.6	12.7	38.4	37.7	43.7	81.1	94.3	68.6	195.4	09

9/15/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	93.6	79.3	115.5	97.3	84.6	85.8	83.7	65.8	59.4	83.5	85.5	24.9	8.0	3.9	4.5	5.0	8.4	10.4	10.3	8.1	6.6	5.1	3.4	2.5	43.1	115.5	02

9/17/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	6.9	5.7	55.2	76.2	161.9	191.3	255.3	234.1	215.3	150.6	60.8	17.5	2.4	2.5	8.8	3.1	2.8	2.4	3.8	3.3	4.3	8.0	69.6	71.5	67.2	255.3	06

9/18/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	88.5	136.5	124.4	147.0	137.2	115.5	122.9	128.6	107.3	99.5	19.6	1.2	1.0	1.0	.7	.9	.8	1.2	2.3	3.0	2.8	4.2	48.9	78.4	57.2	147.0	03

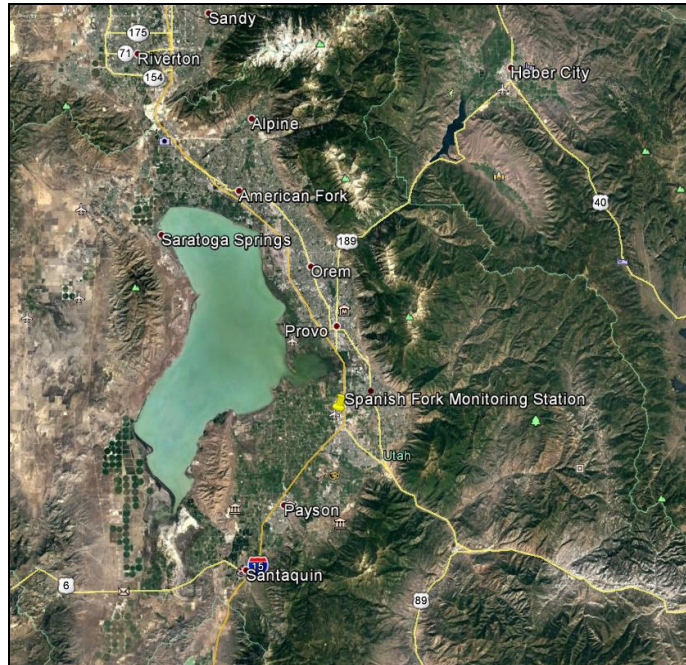
9/19/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	85.4	73.5	77.4	114.2	115.7	121.5	125.2	214.5	245.3	257.4	183.2	28.8	2.3	.6	.7	.6	.9	.9	2.7	2.2	2.4	2.7	3.0	4.7	69.4	257.4	09

9/21/2018

Parameter	SiteName	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Summary		
																										Avg	Max	Hr. of Max
MC	SF	16.7	33.9	46.3	54.8	64.7	98.4	72.7	90.6	90.1	42.9	44.4	37.7	36.0	21.6	13.1	6.7	3.8	3.4	7.4	5.6	11.5	8.8	30.3	42.3	36.8	98.4	05

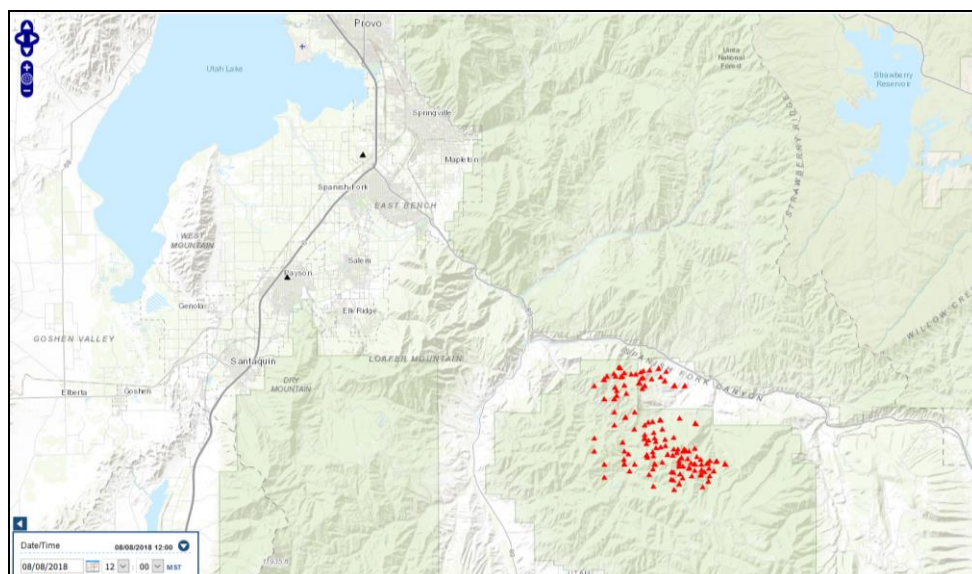
The monitoring station, as shown on the Google Earth map, is located within the fence line of the Spanish Fork airport.



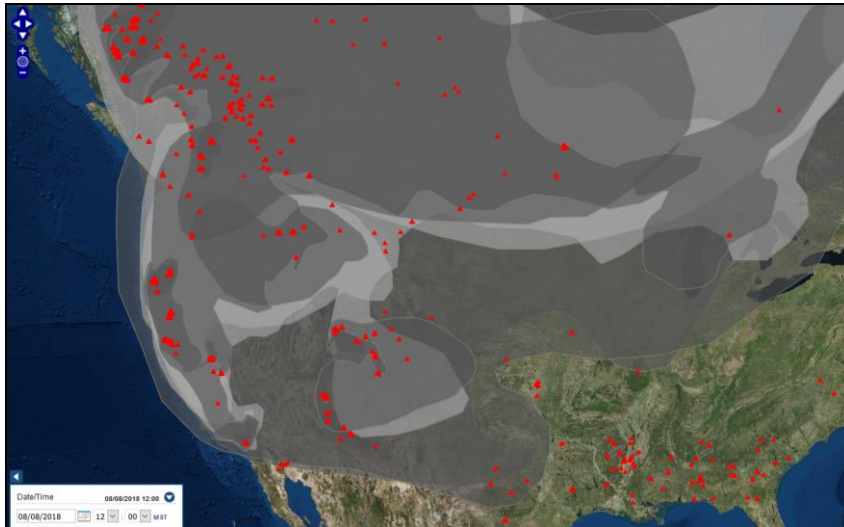
Conceptual Model

Coal Hollow Wildfire

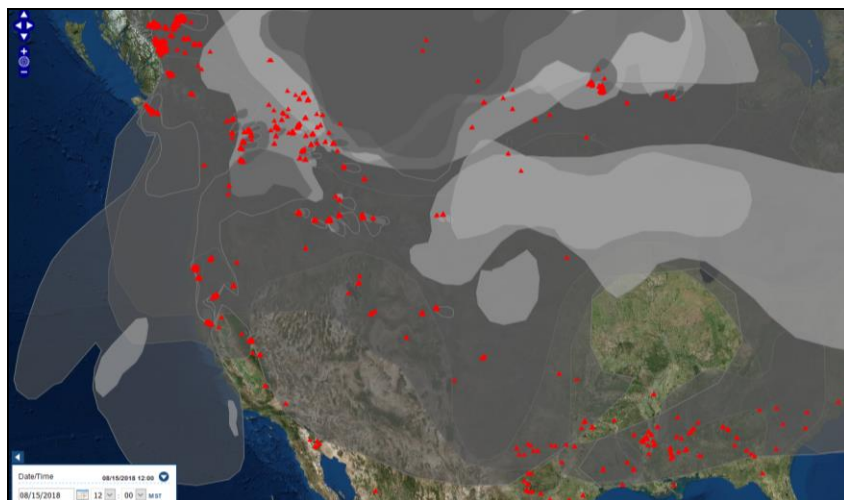
The U.S. Forest Service released a statement on August 5, 2018 that the Coal Hollow wildfire, located about three miles south of U.S. Highway 6 had started by lightning and had burned 200 acres of mixed conifer, pinion-juniper, Gable oak and other brush. The extreme smoke hampered firefighting on the ground, and from the air. The wildfire grew quickly to tens of thousands of acres, causing the Utah Highway Patrol to close the highway for short periods and order evacuations of the area. The red markers designate the fire complex on August 8, 2018 near U.S. Highway 6.



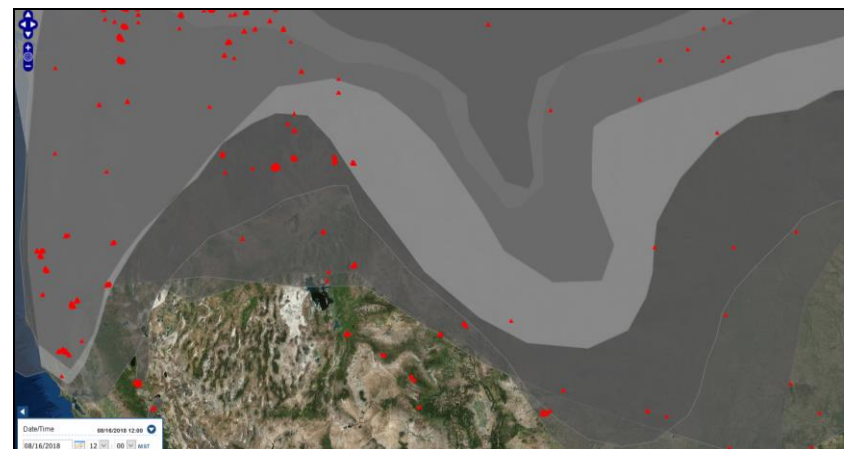
Smoke from multiple western wildfires (as shown below), as well as the Coal Hollow wildfire, created complex mixed plumes of smoke throughout Utah and western and plains states.



These western mixed smoke plumes persisted until August 15, 2018.



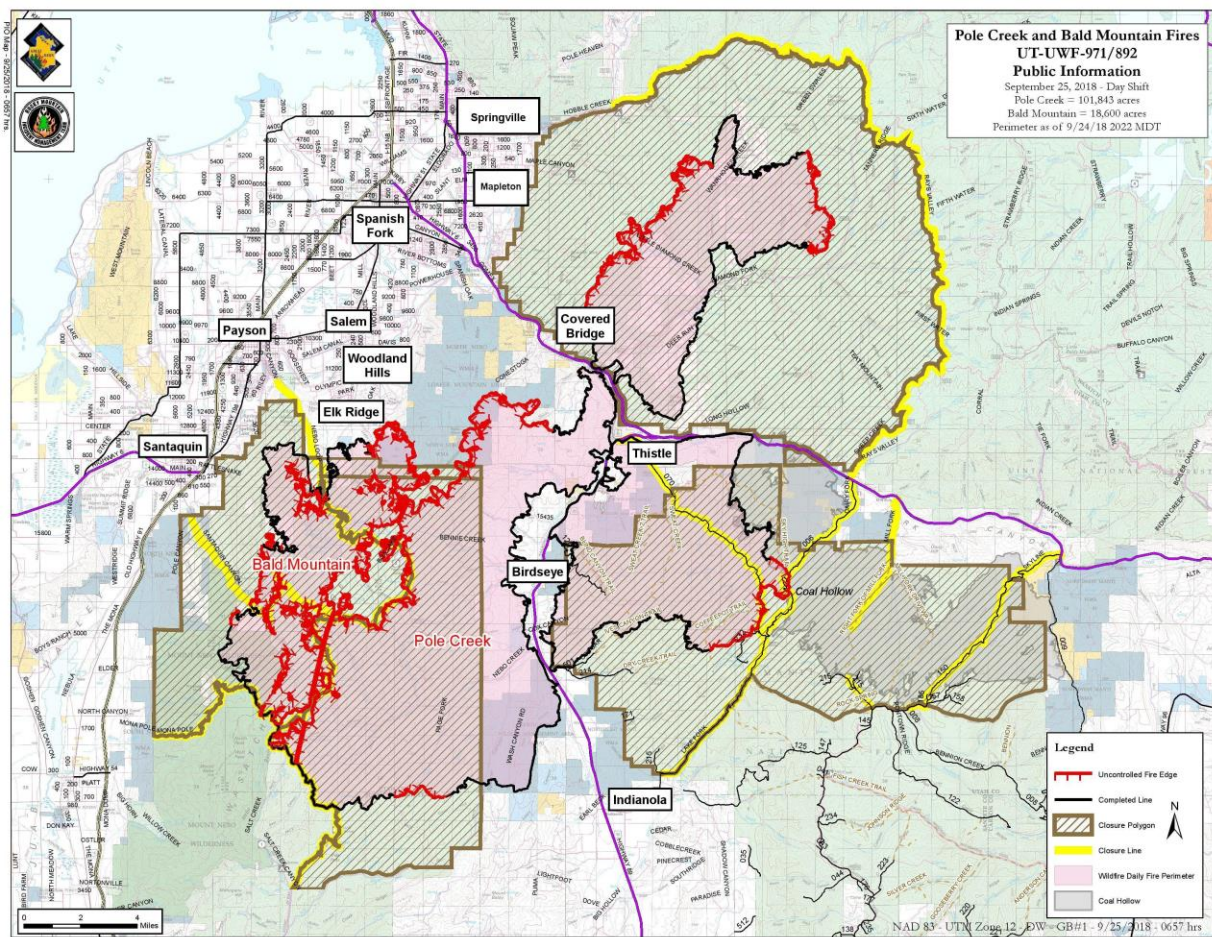
Meteorological conditions on August 16, 2018 caused smoke plumes from other western states to migrate in a northerly direction.



The 31,661 acre Coal Hollow wildfire was deemed 100% contained on August 21, 2018. The wildfire continued to smolder causing smoke to migrate with prevailing winds throughout September.

Pole Creek and Bald Mountain Wildfires

According to the U.S. Forest Service, the Pole Creek Fire started by lightning on September 6 at 10:39 a.m. On September 10, wind speeds increased dramatically and the fire made very large runs over the same 48-hour period as the Bald Mountain Fire burned to the west. The Pole Creek Fire jumped Highway 89 to the east and migrated into the Coal Hollow Fire. The Pole Creek Fire subsequently jumped north over Highway 6 burning in Diamond Fork Canyon.

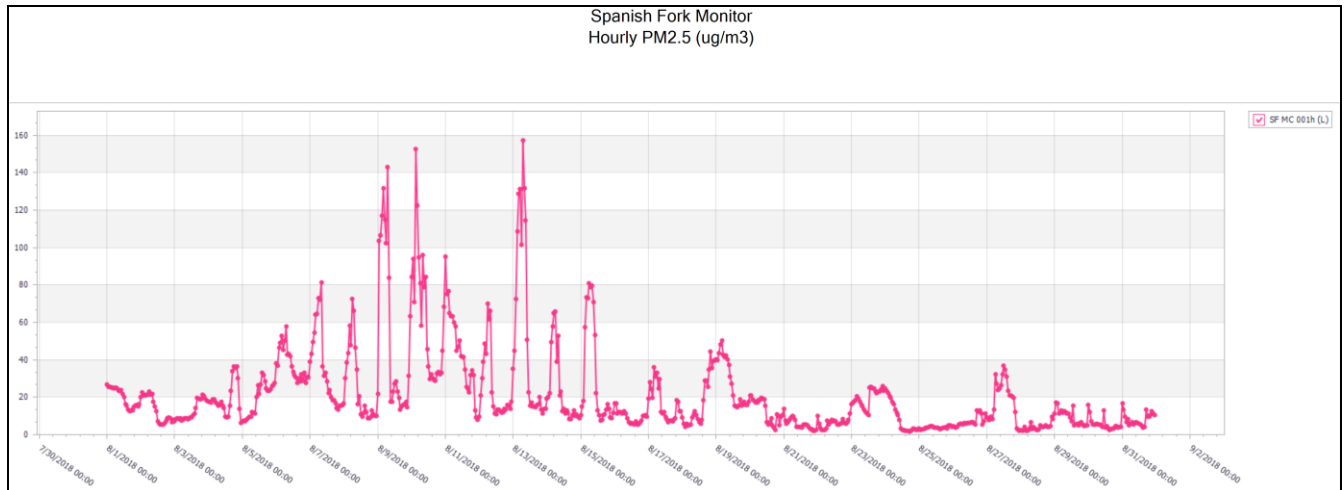


Full containment of the complex was reached on October 3, 2018.

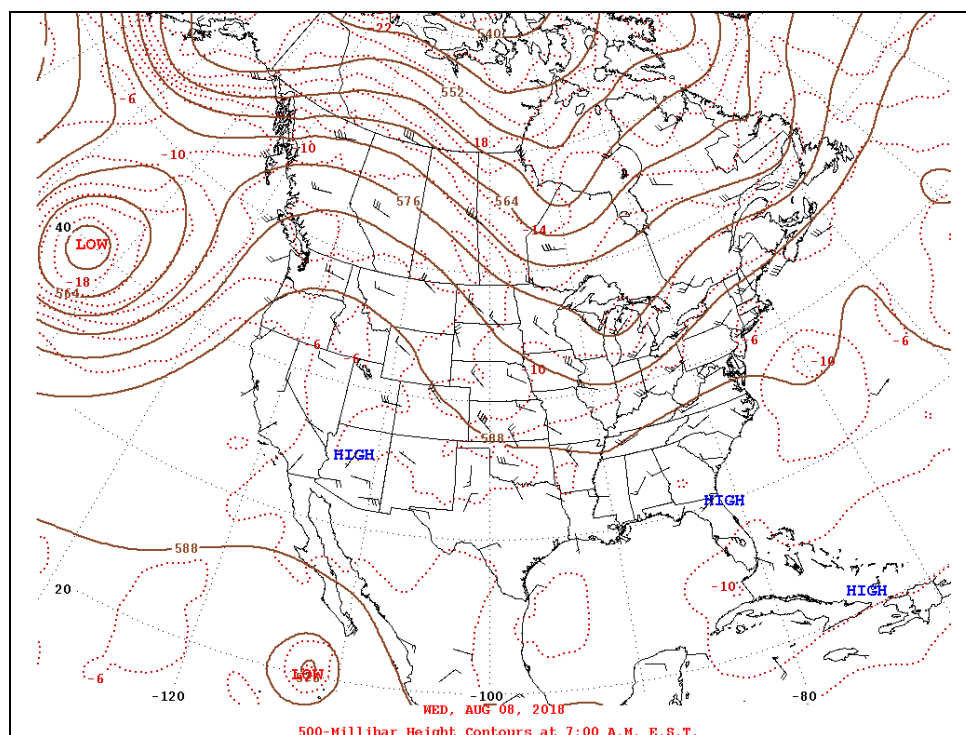
Air Quality Impact and Clear Causal Relationship

Coal Hollow and Western Wildfires

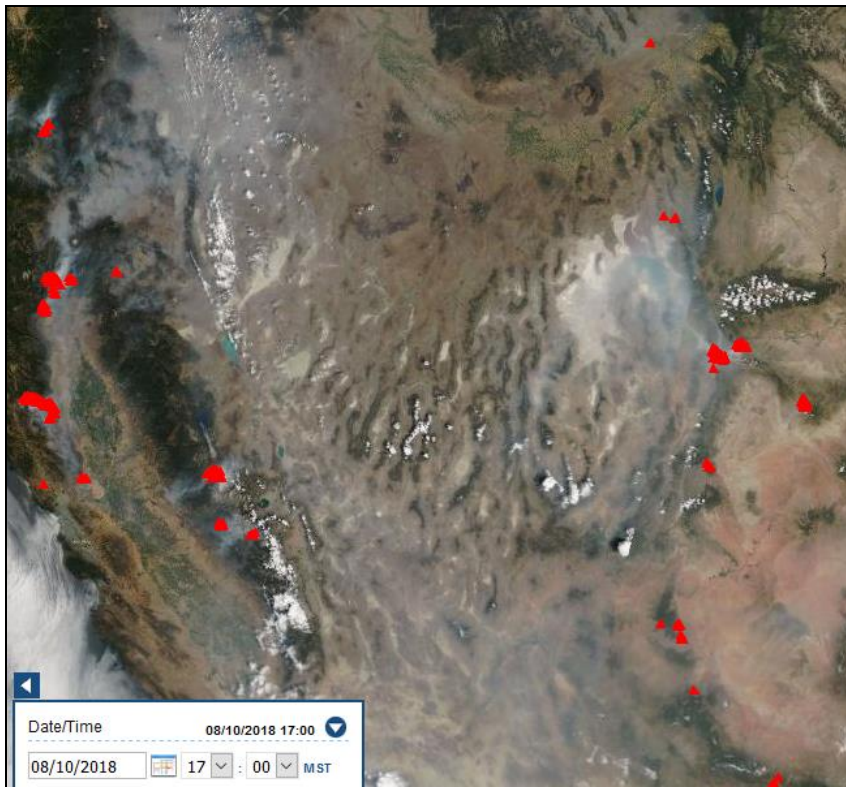
The PM_{2.5} hourly trend chart for August shows elevated PM_{2.5} levels throughout the month due to multiple western state wildfires. The highest peaks correspond with the filter data exceedances related to the Coal Hollow Wildfire.



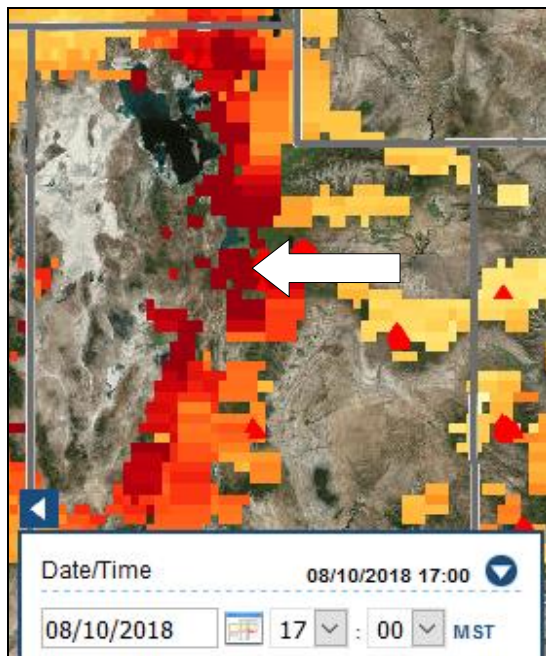
Stable atmospheric conditions on August 8 due to high pressure centered in Arizona, transported smoke from other western states to Utah, causing the co-mingling of the Coal Hollow and western states smoke plumes.



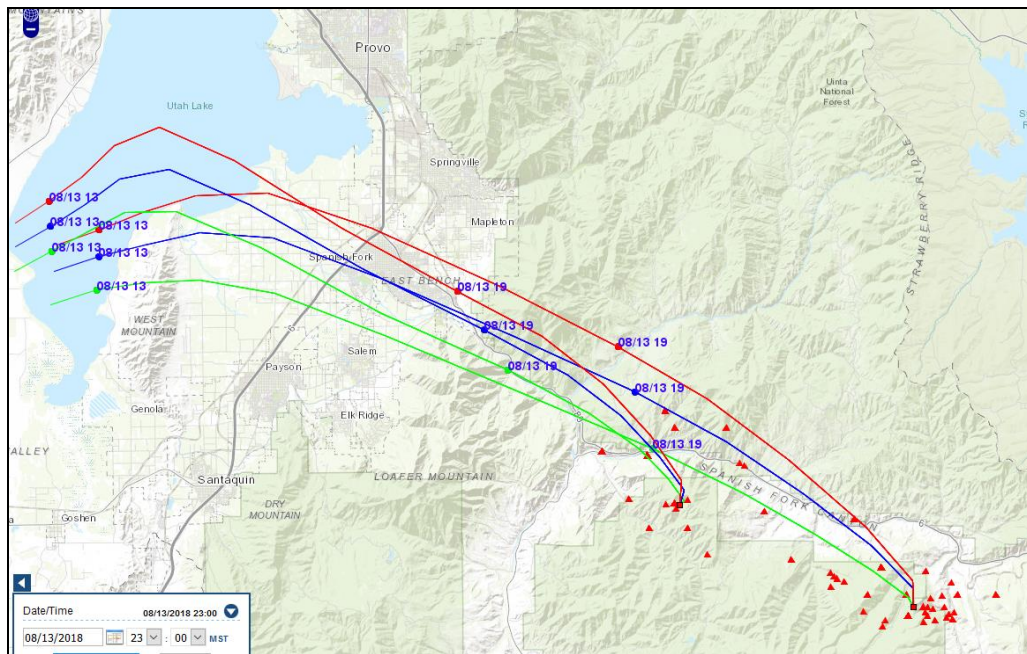
Smoke transport throughout the western states on August 8 can be visibly verified with MODIS satellite imagery. The red markers are the wildfire locations. The off-gray wisps are smoke plumes.



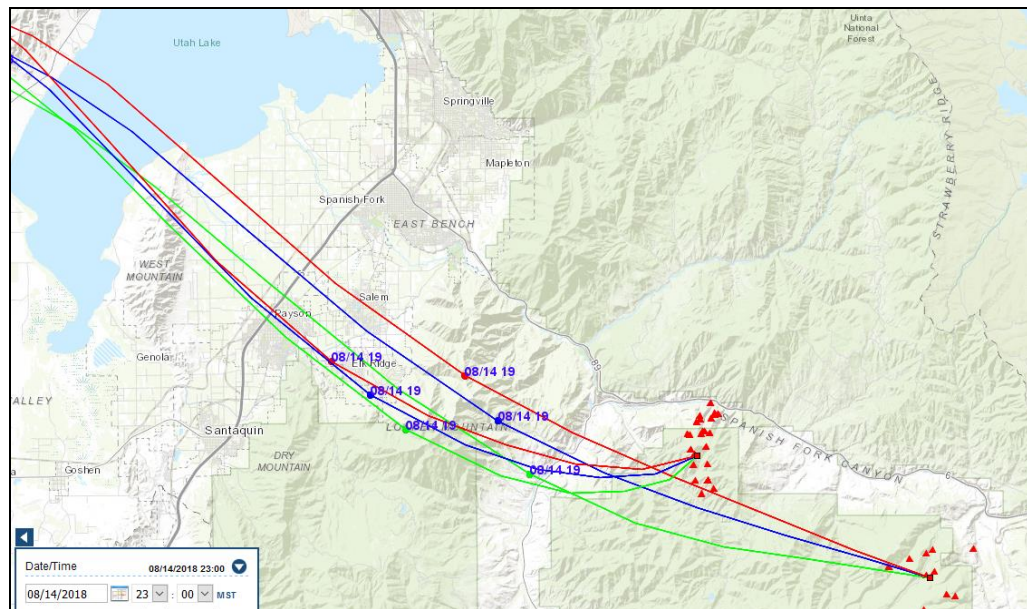
Aerosol optical depth (AOD) can provide supporting evidence of smoke. Smoke intensity is indicated by an increasing color scheme, with red as the maximum AOD. Note the AOD intensity along the fire complex (white arrow).



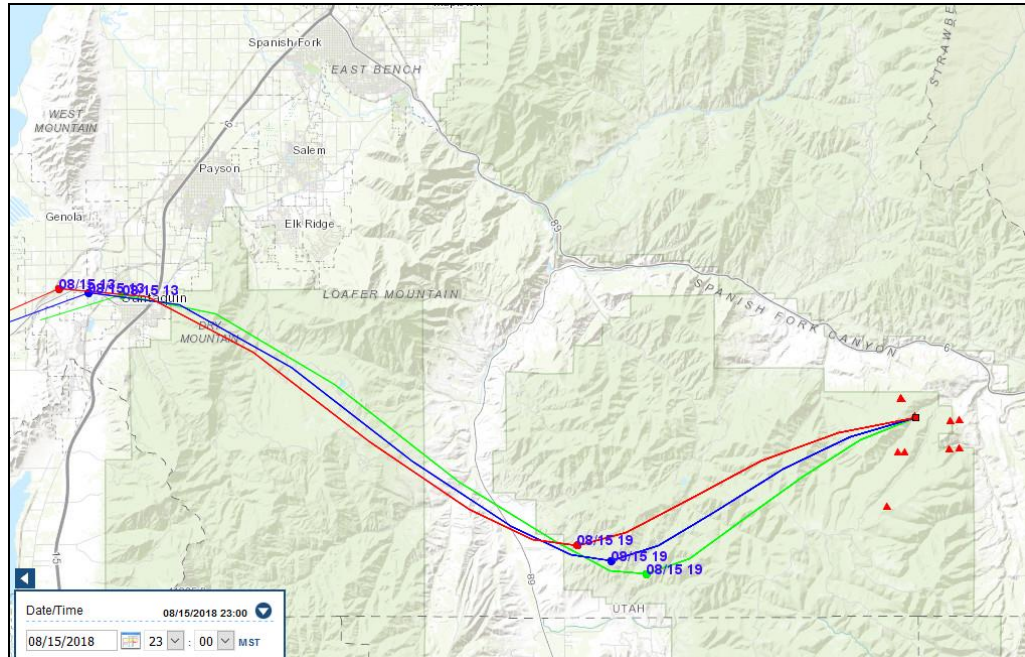
12-hour back trajectories on August 13 indicate continued smoke patterns across Spanish Fork.



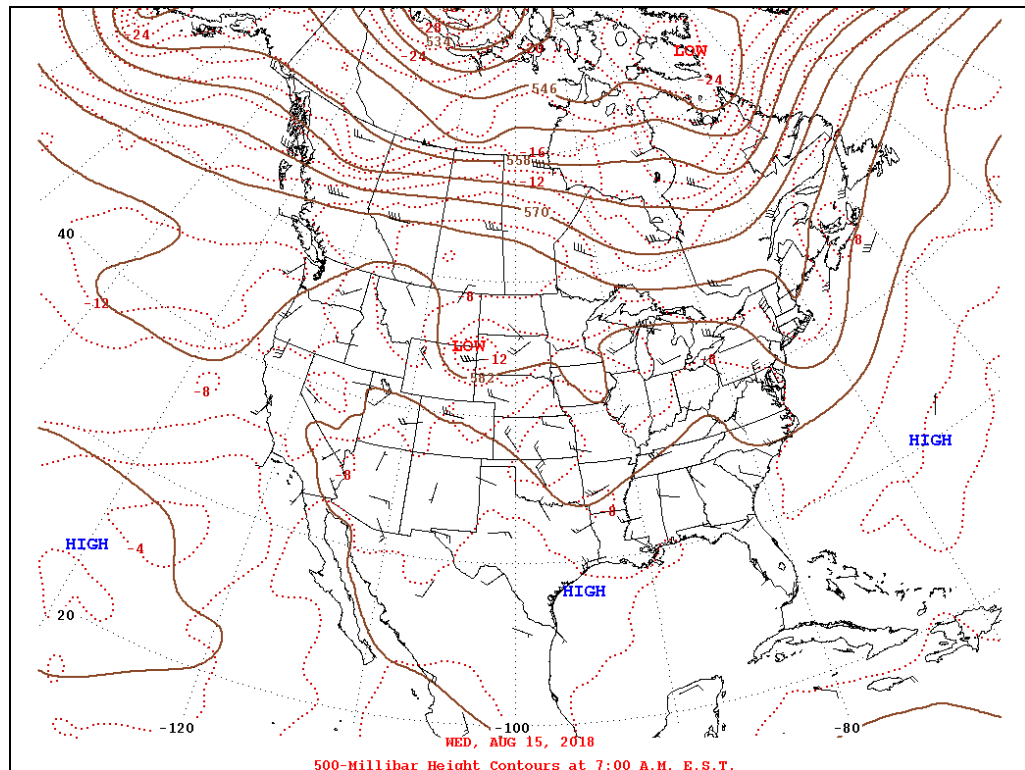
The smoke plumes appear to have shifted in a southerly direction on August 14, which would explain why the filter data result was reduced that day to $26.2 \mu\text{g}/\text{m}^3$, but still elevated above normal conditions.



The size of the wildfire and the extent of smoke in Spanish Fork diminished substantially by August 15.

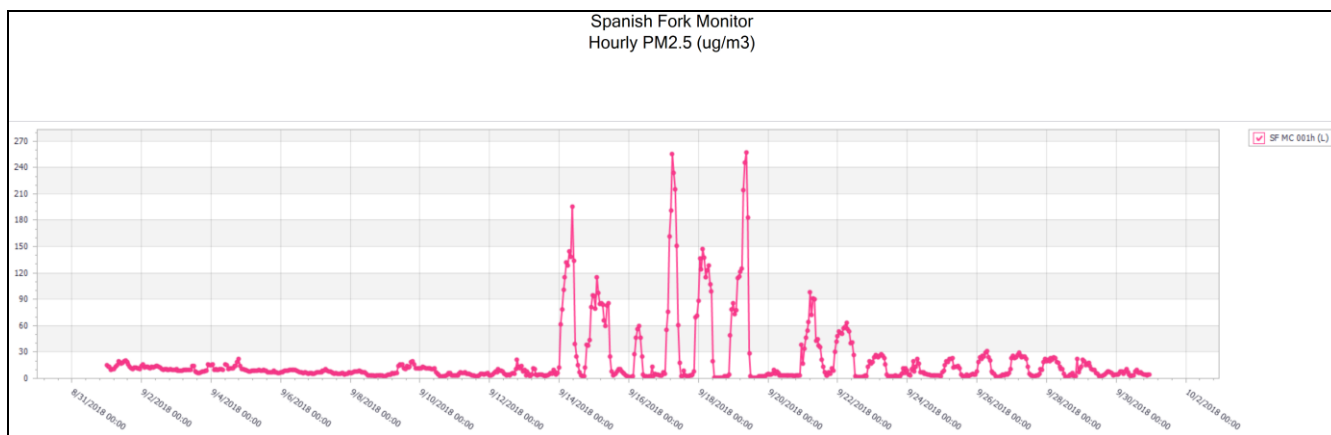


Southerly flow on the 15th reduced smoke interstate transport to Utah.

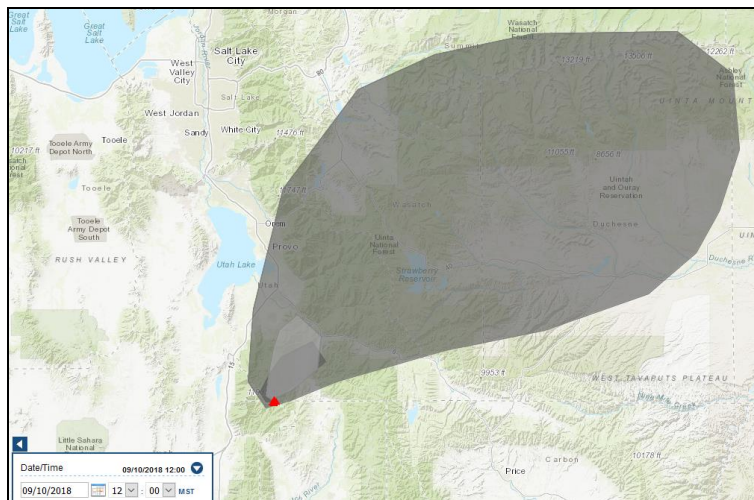


Pole Creek and Bald Mountain Wildfires

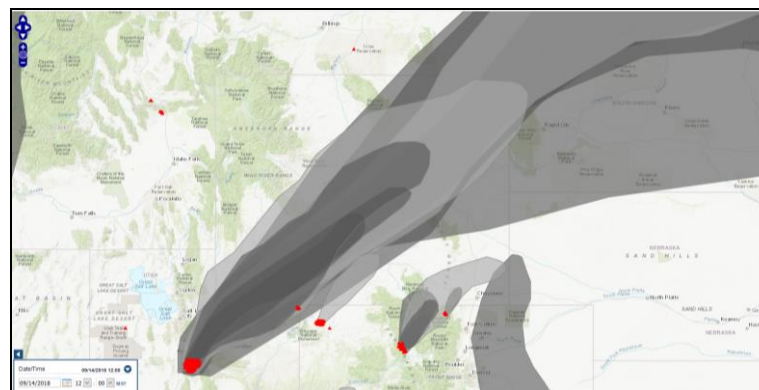
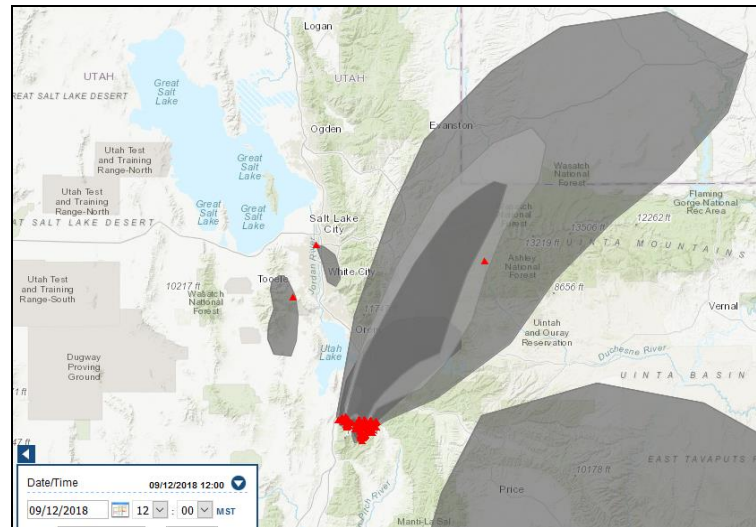
The PM_{2.5} hourly trend chart for September shows elevated PM_{2.5} levels beginning September 14, when the combination of fire complex growth and meteorological shift caused smoke to flow to Spanish Fork.



First day of the fire complex smoke plume projection.



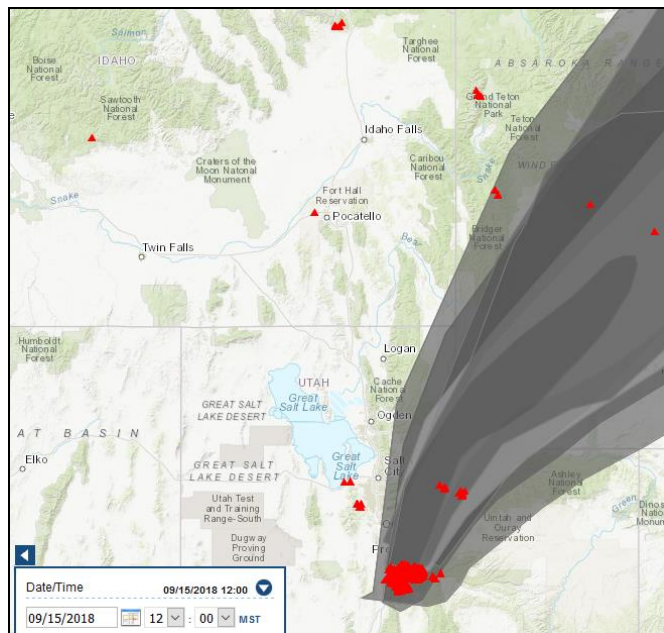
The fire complex exploded in size generating a larger smoke plume two days later.



September 14



September 14, Visual Confirmation



September 15



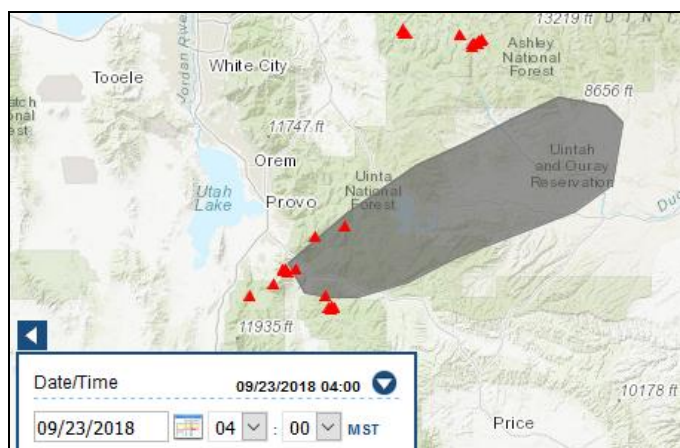
September 15, Visual Confirmation

Smoke intensity increased dramatically on September 17. The U.S. Forest service issued the following fire complex notice on September 17:

"Fire behavior continues to be driven by strong southwest winds. Near Red Flag weather conditions are predicted to last through Tuesday evening. Fire behavior is expected to continue to be extreme and fast moving.

"Smoke from these fires will continue to be pushed north and northeast. Air quality in Spanish Fork registered Very Unhealthy this morning, but is expected to improve to Good by late this morning. Elsewhere, air quality along the Wasatch Front from Payson to Point of the Mountain is registering Moderate, and may improve this afternoon. Heber City and southwest Wyoming may experience more smoke today due to increased fire activity north of US Highway 6. Air quality expected to stay in the Moderate range depending on wind direction and smoke movement."

Strong southwestern winds on September 23rd dispersed and transported smoke towards the northeast, resulting in smoke ventilation in Spanish Fork.



Historical Data

The continuous monitor was installed January 24, 2018, so we are unable to compare that data to past summer years. The filter monitoring frequency has changed from 1 in 3 to daily and there are some data gaps in past years, so a comparison of historical monthly statistics is presented below.

August PM 2.5 Statistics

Year	Minimum Value	Maximum Value	Average Value
2018	4.2	68.9	21
2017	2.9	23*	9.2
2016	4.6	19	9.0
2015	3.9	22.4^	8.6
2014	2.5	12.9	5.0

*Smoke from Nevada and California Wildfires

^Smoke from Idaho and Oregon Wildfires

September PM 2.5 Statistics

Year	Minimum Value	Maximum Value	Average Value
2018		76.3*	
2017	2.3	39.9*	10.6
2016	0.8	7.5	4.8
2015	4.1	8.7	5.8
2014	2.8	11.5	5.1

*Wildfire Exceptional Event

Reasonable Controls

The Exceptional Events Rule requires that states have in place reasonable controls during exceptional events. Some of the western wildfires were located outside of the State of

Utah, beyond Utah control. The local fires were caused by natural lightning events, thus they are unavoidable.

The DAQ smoke management plan includes regulations that address open burning, prescribed burning and wildfire management.

- R307-202. Emission Standards: General Burning. This rule regulates when general burning can be conducted under permits issued by local fire authorities. Open burning periods are established in different parts of the state when the atmosphere can safely disperse smoke and when wildfire hazard is low. This rule also prohibits the burning of certain materials.
- R307-204. Emission Standards: Smoke Management. This rule is designed to mitigate the impact on public health of prescribed fires and wildfires by establishing strict requirements of land owners, state and federal agencies that conduct prescribed fires and actions necessary by the wildfire coordinators during a wildfire event. The state smoke manager (a Bureau of Land Management employee) processes all prescribed fire requests prior to submitting those requests for DAQ director approval. He assures that prescribed fire plans contain a smoke mitigation plan and that the burn will comply with R307-204.

The Department of Natural Resources has fire management jurisdiction in unincorporated and forest lands through R652-120.

- R652-120. Wildland Fire. The State Forester enforces open burning of yard waste through a burn permit in unincorporated lands in the same manner as R307-202 which is designed for incorporated lands. This rule also deals with fire management and suppression and prescribed fire management.

Mitigation

1. News releases during the event advised citizens of the potential health impacts of smoke from the wildfires.
2. Web sites about emissions from wildfire are posted on the DEQ web site. They cover the health impacts of PM and actions a person could take to minimize exposure to PM.
3. UDAQ issues a 3-day air quality forecast in which we advise the public on air quality and provide smoke warnings.

Proof of Public Comment